ART. IX.—*On the Australian Species of Amathia.*

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Several species of Amathia have long been known to occur on the Australian coasts, and were described by Lamouroux and Lamarck. Of late years several others have been added to the list. A great deal of confusion, however, exists as to what these species really are. This has been partly owing to the imperfection of the descriptions, and in some cases to the want of figures.

In the present paper I give descriptions and figures of all those with which I am acquainted, by which I trust that Australian observers will have no difficulty in identifying the species. No doubt others will be discovered, especially from New South Wales, Queensland and Northern Australia, from which my materials are very scanty.

AMATHIA, Lamouroux.

(= SERIALARIA, Lamarck.)

Class, Polyzoa. Division Ectoprocta. Order Infundibulata. Sub-order Ctenostomata. Family Vesiculariidæ.

Generic character.—Zoarium radicate, with free, filiform, usually dichotomous branches, divided by more or less distinct joints or partitions. Zoœcia sub-tubular, occasionally in one, but mostly in two, parallel rows, in continuous series or in distinct groups, which are placed on one, or rarely on two, sides of the branches, or are wound spirally partially or wholly round them.

* Zoœcia forming a continuous or interrupted spiral.

1. A. SPIRALIS, Lamouroux.

(Plate A., Fig. 1.)

Amathia spiralis, Lamouroux, Hist. des Polypiers Coralligènes Flexibles, p. 161, pl. iv., fig. 2; Expos. Methodique des Genres de Polypiers, p. 10, pl. 65, figs. 16, 17; MacGillivray in McCoy's Prodromus of Zoology of Victoria, pl. 185, fig. 2.

Serialaria convoluta, Lamarck, Anim. Sans Vertebres, ed. 1, ii., 131; ed. 2, ii., 170; ed. 3, i., 212.*

Serialaria spiralis, De Blainville, Manuel d'Actinologie, p. 476.

Zoarium forming dense tufts several inches high, attached by fine radical tubes. Branches erect, stiff, dichotomously divided. Zoœcia long, narrow, united laterally through their whole length to form a continuous uniserial spiral, interrupted only at the bifurcations and closely applied to the branch; each zoœcium convex, the contiguous walls of adjoining zoœcia united and projecting upwards as slight points.

Port Philip Heads. Port Jackson, Mr. Whitelegge.

Grows in large tufts, the largest I have seen being nearly five inches high. The branches are long, dichotomously divided, with a length of a quarter to half an inch between the bifurcations. The zoœcia are long, narrow, united side to side to form a continuous spiral closely united or adpressed to the branches which they conceal, and interrupted only at the bifurcations. They are convex, separated by grooves, the united contiguous margins projecting upwards as small points; when dried the anterior surface is collapsed and depressed, the separating walls projecting and their upward prolongations being more prominent.

2. A. BICORNIS, Tenison Woods.

(Plate A., Fig. 2.)

Serialaria spiralis, Tenison Woods, Proc. Roy. Soc., New South Wales, July, 1877.

Amathia bicornis, T. Woods, Proc. Roy. Soc., Victoria, June, 1879; MacGillivary in McCoy's Prod. Zool. Vict., pl. 185, fig. 1.

Zoarium forming dense tufts one or two inches high. Branches irregularly divided. Zoœcia rather long, slightly convex, closely united side to side and arranged in spiral clusters of about two complete turns, the cylindrical stem being unoccupied for nearly the same length between the clusters; each zoœcium with a long hollow process on each side, about a half of its length and with a rounded sinus between them.

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* My copy is ed. 3, Brussels, 1837. It is, I believe, the same as the 2nd edition, edited by Deshayes and Milne Edwards, the extensive additions and new observations on the Polypes being by the latter naturalist. The references to the other editions are taken from Miss Jelly's invaluable Catalogue of Marine Bryozoa.

Port Phillip Heads. Marouba Bay, New South Wales, Mr. Whitelegge.

This is a very marked species, at once distinguished by the separate spiral clusters of zoœcia with the free stem between them, and by the peculiar long, thick, hollow processes from the orifices.

Dr. Pergens, writing without evidently having seen Mr. Woods' proposed name *A. bicornis* (Bull. Soc., Malacol, Belgique, 1887), considers that the name *A. spinosa* attached by Desmarest and Leseur to a figure of this species should be retained. As, however, neither description nor figure was ever published, Mr. Tenison Woods' name must stand.

3. A. convoluta, Lamouroux.

(Plate A., Fig. 3.)

Amathia convoluta, Lamouroux, Pol. Corall. Flex., p. 160; De Blainville, Man. d'Actinologie, p. 476.

Serialaria crispa, Lamarck, Anim. Sans Vertebres, ed. 1, ii., 131; ed. 2, ii., 172; ed. 3, i., 212.

Amathia spiralis, Busk, Challenger Polyzoa, pt. ii., p. 34, pl. vi., fig. 2.

? A. tortuosa, Busk, l.c. p. 34, pl. vi., fig. 1.

Zoarium forming tufts of rather loose, long, straggling, irregularly divided branches. Zoœcia long, narrow, arranged in a continuous spiral interrupted at the divisions of the branches, diverging from the axis above and leaving portions of the stem visible between the turns; each zoœcium convex, the contiguous margins not produced into a point.

Port Philip Heads, Mr. J. Bracebridge Wilson.

Forms loose tufts of an olive or brownish colour, the branches two or three inches high and irregularly divided. The zoœcia are long, narrow, closely united laterally except sometimes at the apertures, and forming an open spiral of about one or one and a half turns in each internode, the free margin diverging considerably from the stems, which are conspicuously visible in the opening of the spiral. The orifices of the zoœcia are not quite so closely united and the adjacent margins are not produced.

No figure was published by Lamouroux or Lamarck, but there can, I think, be no doubt that this is the species intended by them. Lamarck gives Schweiger as an authority for the name *A. convoluta*, but I have not seen his work. It is undoubtedly Busk's *A. spiralis*, and I can see no difference between that and his *A. tortuosa*.

4. A. TORTUOSA, Tenison Woods.

(Plate A., Fig. 4.)

Amathia tortuosa, Tenison Woods, Proc. Roy. Soc. Victoria, June, 1879; MacGillivray in McCoy's Prod. Zool. Vict., pl. 185, fig. 3.

Amathia connexa, Busk, Challenger Polyzoa pt., ii., p. 35, pl. vi., fig. 3.

Zoarium forming long, straggling, irregularly divided, rather slender, cylindrical, transparent branches, several inches high. Zoœcia rather long, in biserial clusters at nearly right angles to the stems and forming an open spiral of one complete turn, occupying greater part of each internode but leaving a small portion inferiorly free.

Port Philip Heads. Port Jackson (Dr. Ramsay).

There can be no doubt that this is the species described and figured by Mr. Woods, and that Busk's *A. tortuosa*, if not identical, as I believe, with *A. convoluta*, is at all events quite distinct from the present.

5. A. DISTANS, Busk.

(Plate C., Fig. 3.)

Amathia distans, Busk, Challenger Polyzoa, pt. ii., p. 38, pl. vii., fig. 1; MacGillivray, Trans. Roy. Soc. South Australia, June, 1889.

Zoarium forming long, slender, straggling, transparent branches. Zoœcia irregularly biserial, united into clusters forming very open spirals of about one complete turn occupying the upper half of each internode.

South Australia.

I have only a small specimen of this species. It is readily distinguished by the long, very slender, filamentous stems and the spiral cluster of zoœcia occupying the upper half of each internode, the lower part being bare. The zoœcia are rather short, and not very closely united.

** Zoœcia in straight or oblique clusters.

† No appendages.

6. A. LENDIGERA, Linnæus sp.

(Plate B., Fig. 1.)

Amathia lendigera, Lamouroux, Pol. Corall. Flex., p. 159; Id. Expos. Method, p. 10; Hincks, Brit. Mar. Pol., p. 516, pl. lxxiv., figs. 7-10; Busk, Challenger Pol., pt., ii., p. 33.

Serialaria lendigera, Lamarck, An. Sans Vertebres, ed. 1, ii., 130; ed. 2, ii., 169; ed. 3, i., 211; De Blainville, Man. d'Actinologie, p. 476; Johnston, Brit. Zoophytes, ed. 2, p. 368.

Zoarium consisting of dichotomously divided, slender, intricately interwoven branches. Zoœcia in straight, biserial clusters of 4-8 pairs, diminishing in height from the proximal to the distal, and occupying the upper third or half of an internode.

Western Port, Rev. Mr. Porter.

Of this the only Australian specimen I have agrees precisely with the well known European form. It is closely allied to the succeeding, under which the distinguishing characters are pointed out.

7. A. OBLIQUA, new species.

(Plate B, Fig. 2.)

Zoarium consisting of slender, dichotomously divided branches, not interwoven. Zoœcia in oblique, biserial clusters of 6-9 in each row, occupying almost the whole length of the straight internodes.

Port Philip Heads.

This is closely allied to *A. lendigera* with which it seems to have been considered identical by Mr. Kirkpatrick. The habit of growth, however, is quite different. It forms tufts of considerable height, one measuring five inches. It is only attached by the bases of the main stems by radical tubes, the branches being quite free and not intertwining or climbing over other objects. The zoœcial clusters are markedly oblique and extend over nearly the whole length of the internodes, never being restricted to so small a portion as the half. The large size of the zoœcial clusters, and its more regular growth give it a much stouter appearance. In both species the zoœcia are more separated than in the others.

8. A. PINNATA, Kirkpatrick.

(Plate C., Fig. 1.)

Amathia pinnata, Kirkpatrick, Ann. and Mag. Nat. Hist., July, 1888.

Zoarium pinnately branched. Zoœcia arranged in biserial clusters of 12-16 pairs, occupying greater part of the front of each internode.

Port Philip Heads, Mr. J. Bracebridge Wilson.

The only specimen I have of this very distinct species is that figured. Being the extremity of a growing branch the secondary branches are not so fully formed as in older parts, one on a side being sometimes undeveloped or aborted.

9. A. BROGNIARTII, Kirkpatrick.

(Plate B., Fig. 3.)

Amathia Brogniartii, Kirkpatrick, Ann. and Mag. Nat. Hist., July, 1888.

Zoarium consisting of dichotomously divided branches. Internodes long, thick and straight, occupied for almost the whole length by a biserial cluster of long, nearly uniform, connate zoœcia.

Port Philip Heads, Mr. J. Bracebridge Wilson.

Distinguished by the great length and straightness of the internodes and the number of the zoœcia from *A. biseriata*, the only species with which it can be confounded. I give Kirkpatrick as the authority for the name, as Desmarest and Leseur, who seem to have indicated it and from whom Mr. Kirkpatrick took the name, merely had figures prepared, and never published either plates or descriptions.

10. A. BISERIATA, Krauss.

(Plate B., Fig. 4.)

Amathia biseriata, Krauss, Corallineen und Zoophyten der Sudsee, 1837, p. 23, fig. 1. *A. inarmata*, MacGillivray, Proc. Roy. Soc. Vict., Nov., 1886; Prod. Zool. Vict., pl. 185, fig. 4.

Zoarium forming large tufts of dichotomously divided branches. Internodes of moderate length, slightly arcuate, almost entirely occupied on one side by a biserial cluster of 6-9 pairs of zoœcia, which usually slightly diminish in height from the proximal to the distal extremity.

Port Phillip Heads. Sealers Cove, Baron von Mueller. Westernport.

When I previously described this species as *A. inarmata* I had not seen Krauss' work, and could not procure a copy of it. After seeing his description and figure, I am satisfied that the Australian and South African species are identical. The amount of curvature of the internodes varies, some being almost straight. From *A. Brogniartii*, it differs in the arching and shortness of the internodes, and the small number of zoœcia, and from *A. Woodsii* in the absence of the confervoid filaments, the smaller number and greater thickness of the zoœcia and their not diminishing in size distally in the very marked manner they do in the latter species.

†† With filamentous or confervoid appendages.

11. A. CORNUTA, Lamouroux.

(Plate D., Fig. 1.)

Amathia cornuta, Lamouroux, Pol. Corall, Flex., 159; pl. iv., fig. 1.

Amathia Australis, Tenison Woods, Proc. Roy. Soc. N.S.W., July, 1877.

Serialaria cornuta, Lamarck, Anim. Sans. Vertebres, Ed. 1, ii., 131; ed. 2, 131; ed. 3, i., 212.

Zoarium consisting of dichotomously divided branches, incurved and intricately interwoven. Internodes short, straight and occupied for nearly their whole length by a biserial cluster of about five pairs of zoœcia, which gradually increase in length from the proximal to the distal. Two long, hollow, curved processes articulated at the end of each zoœcial cluster.

Port Phillip Heads. Guichen Bay, South Australia, Rev. J. T. Woods. Port Jackson.

This is undoubtedly the *A. cornuta* of Lamaroux, although he only figures a single row of zoœcia; and there is no doubt it is also the species intended by Tenison Woods, but which I wrongly referred in the Zoology of Victoria to that previously described by Goldstein as *A. Woodsii.* It is distinguished by the zoœcia in the clusters increasing slightly in height from the proximal to the distal, and by the peculiar processes from the anterior extremity of the clusters.

11. A. WOODSII, Goldstein.

(Plate B., Fig. 5.)

Amathia Woodsii, Goldstein, Journ. Microsc. Soct. Vict., 1879.

A. Australis, MacGillivrary in McCoy's Prod. Zool. Vict., pl., 185, fig. 5.

Zoarium forming tufts several inches high of dichotomously divided branches. Internodes of moderate length, slightly arched, each occupied for three-fourths of its length by a biserial cluster of 5-7 pairs of zoœcia, diminishing regularly in height from the proximal to the distal; the terminal clusters having beyond the distal zoœcia a pair of large, confervoid and frequently branched processes; and occasionally a similar process replacing a branch at a bifurcation.

Port Phillip Heads. South Australia. Port Jackson. Port Stephen, N.S.W., Baron von Mueller.

At once distinguished by the regularly diminishing clusters of zoœcia and the long branched confervoid processes. One of these processes frequently seems to replace a branch at a bifurcation. They ought possibly to be considered as young or aborted branches.

I regret that I unfortunately overlooked Mr. Goldstein's excellent description and figure when previously describing this species.

13. A. Wilsoni, Kirkpatrick.

(Plate D., Fig. 2.)

Amathia Wilsoni, Kirkpatrick, Ann. and Mag. Nat. Hist., July, 1888.

Zoarium irregularly branched, of a light brown colour. Main stems having in front a biserial cluster of 6-9 pairs of zoœcia occupying the upper part of each internode; at each joint giving off three branches, two lateral and one smaller posterior; the lateral branches divided into (usually) three internodes; the first two internodes almost entirely occupied by a continuous double row of 7-12 pairs of zoœcia and giving off at the joints two aborted branches; the third internode smaller, with the zoœcia less distinct and terminated by three abortive branches or plumose processes which are thick, glassy, divided into two or three internodes and at each joint give off a short pointed process. The posterior branches from the main stem consisting of a single celliferous internode terminated by three abortive branchlets.

Port Philip Heads, Mr. J. Bracebridge Wilson. Encounter Bay, S.A.

This beautiful species cannot be confounded with any other. The lateral branches turned forwards and arching inwards, with the glassy abortive branchlets, give the whole a very elegant plumose appearance. The zoœcia are of considerable length and closely connate. The abortive branchlets, as in fact are also the main stems and other internodes, are hyaline and subtransparent.

14. A. plumosa, MacGillivray.

(Plate C., Fig. 2.)

Amathia plumosa, MacGillivray, Proc. Roy. Soc., Victoria, November, 1889.

Zoarium forming large tufts. Primary branches cylindrical, divided regularly by partitions or joints, destitute of zoœcia. Secondary branches given off at the joints in regular diverging pairs, each pair from an opposite side of the stem to the succeeding, the zoœcia being turned slightly towards the stems; each branch bifurcates, the internode before bifurcation occupied, except at the basal portion, by a biserial cluster of about six pairs of cylindrical zoœcia and each branch of a bifurcation having a similar or smaller group; each of these branches terminating in a pair of confervoid filaments which again divide at their extremities.

Port Philip Heads.

A beautiful species distinguished from all the others by the barren primary stems and the opposite celliferous branches with the confervoid terminating filaments.

EXPLANATION OF FIGURES.

Plate A.

Fig. 1.—Amathia spiralis, nat. size. Fig. 1*a*.—Portion magnified.
Fig. 2.—A. bicornis, nat. size. Fig. 2*a*.—Portion magnified.
Fig. 2*b*.—Group of Zoœcia more highly magnified.
Fig. 3.—A. convoluta, nat. size. Fig. 3*a*.—Portion magnified.
Fig. 3*b*.—Another portion of the same.
Fig. 4.—A. tortuosa, nat. size. Fig. 4*a*.—Portion magnified.

Plate B.

Fig. 1.—A. lendigera, nat. size. Fig. 1*a*.—Portion magnified.
Fig. 2.—A. obliqua, nat. size. Fig 2*a*.—Portion magnified.
Fig. 3.—A. Brogniartii, nat. size. Fig. 3*a*.—Portion magnified.
Fig. 4.—A. biseriata, nat. size. Fig. 4*a*.—Portion magnified.
Fig. 5.—A. Woodsii, nat. size. Fig. 5*a*.—Portion magnified.

Plate C.

Fig. 1.—A. pinnata, nat. size. Fig. 1*a*.—Portion magnified.
Fig. 2.—A. plumosa, nat. size. Fig. 2*a*.—Portion magnified.
Fig. 3.—A. distans, nat. size. Fig. 3*a*.—Portion magnified.

Plate D.

Fig. 1.—A. cornuta, nat. size. Fig. 1*a*.—Portion magnified.
Fig. 2.—A. Wilsoni, nat. size. Fig. 2*a*.—Portion of anterior aspect of branch magnified. Fig. 2*b*.—Portion of posterior surface of same.